The Acceptability of Fruit-flavored Vegetable Popsicles Among Children Ages 3-7.

An Honors Thesis (HONRS 499)

By

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Abstract:

The purpose of this project was to find an acceptable alternative to eating raw vegetables for children ages 3-7. Vegetables were masked with fruit flavors and served as popsicles which are well liked by children. Two different age groups and four different vegetables, in three different popsicle flavors, were used in the study. Comparisons were made based on age, flavor, color, willingness to eat again, and the children's attitudes regarding vegetables. 85.4% of the children liked the carrot popsicles, and 81.3% stated they would eat it again. 47.9% of the children liked the beet popsicles, and 54.2% stated they would eat it again. 36.7% of the children liked the broccoli/celery popsicles, and 40.8% stated they would eat it again. The vegetable popsicles were well liked by the children overall, and can be used as an alternative for eating raw vegetables.

Acknowledgements:

I would like to thank Dr. Alice Spangler, my advisor for this project, who has been very helpful in assisting me with the design and execution of this project. I also would like to thank Ms. Robin Box, Mr. Dan Swygart, and all teachers involved for allowing me to test my popsicles with your children at the Child Study Center and St. Joseph School. I would like to thank Dr. Tom Harris for taking the time to analyze the results for me. I want to thank the Office of Undergraduate Research for providing me with a grant to conduct this project. And finally to my roommates, Amy and Briar, thank you for being my guinea pigs and not running away every time I said, "Here, taste this. . "

Introduction

A study by Dennison, et al. (1) of 168 children, ages 2 and 5, revealed that only 25% consumed the recommended number of servings of vegetables per day. In this same group of children, 80% consumed the recommended amount of fruit, with fruit juice accounting for 54% of those servings (1). Those children not receiving the proper amounts of fruits and vegetables had a higher risk of inadequate intake of nutrients such as Vitamin A and Vitamin C (1). This study suggested the importance of finding a way to increase vegetable consumption with children.

Researchers also suggested that food preferences developed and dietary modification made early in life are more likely to remain with the child in later years (2). According to Birch (3), the food parents feed their children has a lasting effect on the taste preferences the children will have as adults. Birch stated (3) that humans are born with very few food preferences and that most food preferences are learned behaviors that are influenced by the environment and association of a food with a particular experience. Because of this, children need to be exposed to vegetables early in their life and in a way that will have a positive effect on the child. This project provided vegetables as a popsicle that is more familiar and well liked by children. The popsicles were also introduced to the children in an environment that was familiar, as well as fun and educational.

Rationale for the Study

The purpose of this study was to find an acceptable alternative to eating raw vegetables for children ages 3-7. An additional purpose was to identify specific taste characteristics of each vegetable popsicle. Further, comparisons were made between two age groups, 3-5 years of age and 6-7 years of age.

Children of this age group tend not to eat raw vegetables, and they are therefore at risk of not consuming the vitamins found in a variety of vegetables. Because of the hesitancy of eating vegetables, the researcher sought a form of vegetable which would be better accepted. The juice from an assortment of vegetables was made into popsicles, which are a familiar snack food and well liked by children. The popsicles were fruit-flavored which tends to be more accepted by children. The vegetables used in this project include beets, carrots, and a combined broccoli and celery. These were matched with the fruit flavors of raspberry, orange, and lime respectively.

The goal of this project was to find a way to persuade children to consume vegetables they may not want or think they like. The "5-A-Day for Better Health" Campaign has increased knowledge of the need to eat fruits and vegetables; however, getting the children to eat something they perceive as not appetizing can be very difficult to achieve. The popsicle was used to provide an alternative form of the vegetable because thoughts and attitudes towards the raw vegetable may inhibit the likelihood that they are consumed.

By not eating vegetables, many children are not consuming the necessary nutrients that are provided in these items. Some of these vitamins, such as folate, and

vitamin A, are found only in certain vegetables. Without eating these vegetables, the children are putting themselves at risk for low vitamin intake.

Methods and Procedures

The study used two different populations of children so as to be able to compare the differences or similarities of preference between the age groups. One group participating in the study was the pre-school class, whose ages range from 3 to 5 years old, at the Child Study Center of the Department of Family and Consumer Sciences at Ball State University. The popsicles were given to both the morning and afternoon classes. Each class contained approximately 17-20 children. The second group of children was the first grade class of Mrs. Peg Aloisio at St. Joseph School in Decatur, IN. This group contained approximately 25 students who ranged in age from 6 to 7 years old. Permission to conduct this study at these locations was obtained from both Ms. Robin Box, Director of the Child Study Center and Mr. Daniel Swygart, Principal of St. Joseph School. The proposed project was reviewed and approved by the Ball State University Institutional Review Board.

The product testing took place during the children's normal snack time at the Child Study Center, (CSC), on three Wednesdays, and at a first grade class of St. Joseph School on three Mondays over a seven-week period.

For purposes of matching data, each child was assigned a random number that served as his/her identification throughout the study. This was done so that each child's

response could be matched over the seven week time period, including their attitudes regarding vegetables, which were obtained at the end of the study. The child's name was never used in any presentation of the data or results.

A consent form was sent to the children's parents 10 to 14 days prior to testing to allow time for them to read, sign, and return the consent form. This also allowed time for the parents to consult the Principal Investigator or Faculty Advisor about any questions they had regarding the study.

Each vegetable was washed, and peeled if necessary, before being placed in a Juiceman Jr.® Juice Machine to obtain the juice. The juice was then flavored using a blend of fruit juice concentrates, extracts, and/or Kool-Aid® in order to obtain a fruit flavor. The juices were diluted with water to obtain a proper consistency and flavor, as well as to aid freezing. Corn syrup was also added to increase the sweetness. The vegetable juice mixture was then placed in 3-ounce popsicle molds to obtain the final product. A short introduction and instructions was read to the children prior to their tasting. The children were not told the identity of the ingredients. The finished popsicles were then given to the children for their acceptance or disapproval and comments.

Each vegetable popsicle was made 24 to 48 hours in advance at the Child Study Center's kitchen to comply with their policies. All ingredients were purchased and brought to the Child Study Center in their original unopened containers. For St. Joseph's School, the popsicles were also made 24 to 48 hours in advance, and the ingredients were purchased at a local grocery store.

After tasting the popsicles, the children were asked to express their acceptance or disapproval of the product by using a smiley/frowning face method of evaluation and

with verbal and non-verbal communication. In order to assess the popsicles, the children were given an evaluation form that was appropriate for their age level. A smiley/frowning face was marked according to the comment made by the child. In addition to the smiley/frowning faces, the children were asked about their general reaction to certain characteristics of the popsicles, such as their opinion about the flavor, color, and whether or not they would eat it again if they were given the opportunity.

In addition to this questioning at the time of testing, the children were asked a few questions regarding their attitudes towards vegetables at the end of the study. The purpose of this questionnaire was to determine whether the child's comments during testing, when they did not know they were consuming vegetables, were similar or different to their attitudes when they were asked specific questions about vegetables.

The study was meant to be a blind study so that the children did not know they were consuming vegetables. Due to circumstances at the time of testing, it was difficult to remove the child from peer influence when being asked about each popsicle. There was not a quiet space, away from the playing or teaching area where the child could be interviewed. However, the influence of peer comments did not seem to play a major role in the answers given by other children.

Results

In this study, 33 Child Study Center children participated, and 22 St. Joseph School students participated. The two age groups were compared with each other in the categories of vegetable, flavor, color, and whether or not the child would eat the popsicle again. The two groups were also compared with each other in the exit survey which

included questions regarding their attitudes, correct identification, and if they ate certain vegetables.

Flavor

After each testing session, each child was asked to assess the flavor of the popsicle. They were asked to choose from, "I like the popsicle," "This popsicle was OK," and "I did not like the popsicle." For the carrot popsicle, a total of 41 children (85.4%) stated that they liked the popsicle (Table 1). After tasting the beet popsicle, 23 children (47.9%) stated that they liked the popsicle. And for the broccoli and celery popsicle, 18 children (36.7%) stated they liked the popsicle. There were highly significant differences ($p<0.01$) in response to flavor acceptability among the 3 types of popsicles in both ages combined, and the Child Study Center and St. Joseph School analyzed separately.

Table 1. Children's Response to Flavor Using Chi Squared Analysis

	Yes		OK		No	
	n	%	n	%	n	%
Both Ages**						
Carrot	41	85.4	4	8.3	3	6.3
Beet	23	47.9	8	16.9	17	35.4
Celery/Broccoli	18	36.7	5	10.2	26	53.1
Child Study Center**						
Carrot	25	92.6	0	0	2	7.4
Beet	17	60.7	0	0	11	39.3
Celery/Broccoli	13	46.4	2	7.1	13	46.4
St. Joseph School**						
Carrot	16	76.2	4	19.0	1	4.8
Beet	6	30.0	8	40.0	6	30.0
Celery/Broccoli	5	23.8	3	14.3	13	61.9

**$p<0.01$

Color

The children were also asked how well they liked the color using the same type of questioning format as for flavor. There were 39 children (81.3%) who liked the color of the carrot popsicle. For the beet popsicle, 39 children (81.3%) stated they liked the color. A total of 32 children (65.3%) stated they liked the color of the broccoli and celery popsicle (Table 2). There were highly significant differences with both ages combined, a significant difference in the Child Study Center children, and interestingly no significant difference in color response among the 3 popsicles were expressed by the St. Joseph children.

Table 2. Children's Response to Color Using Chi Squared Analysis

	Yes		OK		No	
	n	%	n	%	n	%
Both Ages**						
Carrot	39	81.3	9	18.8	0	0
Beet	39	81.3	5	10.4	4	8.3
Celery/Broccoli	32	65.3	10	20.4	7	14.3
Child Study Center*						
Carrot	21	77.8	6	22.2	0	0
Beet	20	71.4	4	14.3	4	14.3
Celery/Broccoli	16	57.1	6	21.4	6	21.4
St. Joseph School						
Carrot	18	85.7	3	14.3	0	0
Beet	19	95.0	1	5.0	0	0
Celery/Broccoli	16	76.2	4	19.0	1	4.8

**$p<0.01$

*$p<0.05$

Willingness to Eat Popsicle Again

Finally, the children were asked whether or not they would eat the popsicle again using the same format as above. A total of 39 children (81.3%) stated they would eat the carrot popsicle again. For the beet popsicle, 26 children (54.2%) stated they would eat the popsicle again. There were 20 children (40.8%) who stated they would eat the broccoli and celery popsicle again (Table 3). There was a highly significant difference in response to willingness to eat the popsicles again with both ages and with St. Joseph School. There was no significant difference with the Child Study Center.

Table 3. Children's Response to Eating Again Using Chi Squared Analysis

	Yes		Maybe		No	
	n	%	n	%	n	%
Both Ages**						
Carrot	39	81.3	3	6.3	6	12.5
Beet	26	54.2	6	12.5	16	33.3
Celery/Broccoli	20	40.8	12	24.5	17	34.7
Child Study Center						
Carrot	20	74.1	1	3.7	6	22.2
Beet	18	64.3	2	7.1	8	28.6
Celery/Broccoli	14	50.0	7	25.0	7	25.0
St. Joseph School**						
Carrot	19	90.5	2	9.5	0	0
Beet	8	40.0	4	20.0	8	40.0
Celery/Broccoli	6	28.6	5	23.8	10	47.6

**$p<0.01$

Correlations between response to flavor, color, and willingness to eat again

Correlations between responses to flavor, color, and willingness to eat the popsicle again for both age groups, Pearson's R value was used to show a correlation between flavor, color, and whether or not they would eat the popsicle again. There was a highly significant correlation in both ages and the Child Study Center between all characteristics evaluated (Tables 4 and 5). There was a highly significant correlation between flavor and willingness to eat again based on the responses of the children at St. Joseph School (Table 6), but not between flavor and color and willingness to eat again and color.

Table 4. Correlation Between Color, Flavor and Eating Again with Both Age Groups

	Color	Flavor	Eat Again
Color	1.00	0.256**	0.230**
Flavor		1.00	0.618**
Eat Again			1.00

** $p<0.01$

Table 5. Correlation Between Color, Flavor and Eating Again with Child Study Center

	Color	Flavor	Eat Again
Color	1.00	0.385**	0.350**
Flavor		1.00	0.533**
Eat Again			1.00

** $p<0.01$

Table 6. Correlation Between Color, Flavor and Eating Again with St. Joseph School

	Color	Flavor	Eat Again
Color	1.00	0.097	0.639
Flavor		1.00	0.733**
Eat Again			1.00

** $p<0.01$

Attitudes Toward and Knowledge of Vegetables

The children were interviewed at the end of the study to find out about their attitudes regarding vegetables and whether they could identify the vegetables used in the study. They were first asked how they felt about eating vegetables with the questioning format of "I like eating vegetables," "Vegetables are OK," and "I do not like eating vegetables." In a comparison of both ages, a total of 30 children (62.5%) stated that they liked to eat vegetables (Table 7).

Table 7. Comparison Between Two Age Groups of Attitude Toward Eating Vegetables in General Using Chi Squared Analysis[a]

	Like Vegetables		Vegetables are OK		Dislike Vegetables	
	N	%	n	%	n	%
Child Study Center	19	59.4	6	18.8	7	21.9
St. Joseph School	11	68.8	3	18.8	2	12.5

[a]No significant difference between these groups

Although the majority of children stated they liked eating vegetables, only 18 children (37.5%) reported having eaten vegetables on the previous day (Table 8). There was no significant difference between the groups in either category, which supports the idea that children are not consuming vegetables.

Table 8. Children's Response to Having Eaten Vegetables the Previous Day Using Chi Squared Analysis[a]

	Ate Vegetables Yesterday		Did Not Eat Vegetables Yesterday	
	n	%	n	%
Child Study Center	13	40.6	19	59.4
St. Joseph School	5	31.3	11	68.8

[a]No significant differences between the groups

The children were asked to name as many vegetables as they were able for the purpose of determining to what extent children were aware of vegetables. In both groups, only one child was able to name five vegetables. In both groups, 8 children (16.7%) were unable to list any vegetables at all (Table 9). There was no significant difference in the number of vegetables named between the two age groups. Of the vegetables listed by the children, carrot, celery, and broccoli were the most commonly named.

Table 9. Children's Ability to Name Vegetables When Asked Using Chi Squared Analysis[a]

	0		1		2		3		4		5	
	n	%	n	%	n	%	n	%	n	%	n	%
Child Study Center	7	21.9	7	21.9	9	28.1	7	21.9	2	6.3	0	0
St. Joseph School	1	6.3	3	18.8	7	43.8	4	25.0	0	0	1	6.3

[a]No significant differences between these groups

Also during the exit survey, the children were asked to identify the vegetables used in the testing. They were simply asked, "Tell me what a _____ looks like." If the child could give the correct color even without any further detail, the answer was counted as a correct answer. The children were then asked if they would eat that vegetable. Any answer of "I do not know" was coded as an incorrect answer, for purposes of analysis for either question. In both groups, 43 children (89.6%) accurately identified a carrot, and 42 students (87.5%) stated they would eat a carrot. In both groups, only 6 children (12.5%) accurately described a beet, however, 16 children (33.3%) stated they would eat a beet. In both groups, 45 children (93.8%) accurately identified what broccoli looked like, and 37 children (77.1%) stated they would eat broccoli. In both groups, 36 children (75%) accurately described what celery looked like, and 34 children (70.8%) stated they would eat celery (Table 10). There was no significant difference in the ability to correctly name vegetables or whether the child will eat a vegetable with the two age groups compared.

Table 10. Children's Ability to Accurately Describe Certain Vegetables and Whether or Not They Would Eat It[a]

	Correct Naming		Incorrect Naming		Will Eat		Will Not Eat	
	n	%	n	%	n	%	n	%
Both Ages								
Carrot	43	89.6	5	10.4	42	87.5	6	12.5
Beet	6	12.5	42	87.5	16	33.3	32	66.7
Broccoli	45	93.8	3	6.3	37	77.1	11	22.9
Celery	36	75.0	12	25.0	34	70.8	14	29.2
Child Study Center								
Carrot	27	84.4	5	15.6	29	90.6	3	9.4
Beet	3	9.4	29	90.6	13	40.6	19	59.4
Broccoli	30	93.8	2	6.3	26	81.3	6	18.8
Celery	24	75.0	8	25.0	21	65.6	11	34.4
St. Joseph School								
Carrot	16	100.0	0	0	13	81.3	3	18.8
Beet	3	18.8	13	81.3	3	18.8	13	81.3
Broccoli	15	93.8	1	6.3	11	68.8	5	31.3
Celery	12	75.0	4	25.0	13	81.3	3	18.8

[a]No significant differences between these groups

Discussion

Throughout this study, the children participants were very eager to give their comments and opinions about the popsicles they were eating. Some of the comments given by the children or their behavior did not agree with statements they had made previously. For example, several children stated that they did not like a particular popsicle, however, they stayed in from their recess to finish it before going outside. Some of the children made comments that strongly suggested their approval. Upon the second visit to the Child Study Center, several children were disappointed with the "purple one" because they wanted another "orange one." Some children also commented

they would not eat a certain vegetable, but they enjoyed eating it as a popsicle when they did not know they were consuming it. This is best exemplified by the 54.2% who stated they would eat the beet popsicle again, but when they were asked if they would eat a beet, 66.7% stated they would not.

If this study were to be repeated, several factors would need to be changed in order to improve the results of the trials. First, the parents would be instructed to not tell their children about the contents of the popsicles. Some of the children knew what the popsicles were made of before tasting, and they were not afraid to let others know either. Fortunately, they quickly dismissed the idea of the popsicles being made of vegetables once they had tasted the fruit flavor. The children need to be educated on the importance of eating vegetables, and to dismiss the idea that all vegetables do not taste "good." Educating children about vegetables at an early age will increase the likelihood of them continuing to eat vegetables as they become adults.

Another necessary change would be getting each child alone to sample the popsicle and to answer the questions regarding flavor, color, and eating it again. The children would then need to be separated from those who had not tasted it yet. This would decrease the amount of peer influence each child received before, during, and after the tasting of the popsicle. At one tasting, the children were identifying the vegetable used, and they were shouting out their disgust even though they were told to remain silent. This therefore caused other children to not like that particular popsicle. This could account for the low numbers of children who liked the broccoli/celery popsicle at St. Joseph School. 23.8% of the children stated they liked the popsicle, and 28.6% stated they would eat the popsicle again. However, due to the circumstance and limitations in

using a classroom, completely separating the children during testing was not possible at this time.

A third change would require the wording of some of the questions. When testing first began, the children at the Child Study Center were saying that they liked the popsicles, but would not eat it again. 92.6% of the children stated that they liked the popsicle, however, only 74.1% stated they would eat the popsicle again. After talking with the instructors, it was suggested to phrase the question to say "tomorrow" because the children may have thought they were to eat another popsicle at that moment in time; to a child "tomorrow" is any day in the future. By making these changes, the study could have possibly had different results; the overall process of testing with children requires a lot of patience and understanding.

For the characteristic of color, the younger age group seemed to be more influenced by the appearance of the popsicle. With the older group of children, there was no significant difference with regard to color. One possibility for this could be that the younger children rely more on the appearance of food to determine whether or not they are going to eat it. Another possibility is that the older children may have been exposed to more foods with a wider variety of colors.

When the children were asked whether they would eat the popsicle again, the results did not coincide with their response to liking or not liking the popsicle. Surprisingly, there were times when the children stated they liked the popsicle but would not eat it again, and there were times when they stated they did not like the popsicle but would eat it again. As stated before, the younger children may have been confused as to when they were expected to eat the popsicle again, and by not wanting another

immediately, their response was no. If the older children did not like the popsicle flavor, they were not inclined to want to eat it again.

Based on the correlations for each age group, the younger children tended to form their opinions about the flavor of the popsicle based on other characteristics of the popsicle. There was a highly significant correlation in the younger children's responses to color and flavor, color and willingness to eat again, and flavor and willingness to eat again. Therefore, all three characteristics of the popsicle seemed to be a factor in their determination of whether or not they like the popsicle. For the older children, there was a highly significant correlation between flavor and willingness to eat again only. This further exemplifies the fact that color played a less significant role in their determination of whether or not they liked the popsicle.

In the exit survey, the children were asked to identify the vegetables used in this study. The majority of children from both age groups were able to correctly identify carrot, broccoli, and celery. The majority of the children in both age groups also stated that they would eat these three vegetables. A surprisingly small amount, 9.4% of the Child Study Center children and 18.8% of the St. Joseph School children were able to correctly identify a beet. Although when asked if they would eat a beet, 40.6% of the younger children stated they would eat a beet. This willingness to eat something they could not identify was rather surprising. Of the older children, 18.8% stated they would eat a beet which is the same percentage who was able to identify a beet.

Conclusions

One of the purposes of this study was to find an alternative form of vegetables to increase consumption in children. The vegetable popsicles tested in this study were overall well liked by the children. The data shows that vegetable popsicles were, in general, well liked by the children. The orange/carrot flavor combination was the best received by the children with 85.4% of the children total liking the flavor. The carrot popsicle also had a high rate of willingness to eat again, with 81.3% of the children stating they would eat it again. The beet/raspberry flavor combination was liked by 54.2% of the children, which is interesting since only 33.3% of the children stated they would eat a beet if it was given to them. The broccoli/celery/lime combination was not well liked by the children, with only 36.7% of the children stating they liked it. The flavor combination may require further alterations that would increase the likelihood of the children eating them. When this was tested, the children were able to recognize the flavor of broccoli and celery; therefore the fruit juices had not masked the vegetable flavor well enough.

The purpose of this study was to find an acceptable alternative to eating raw vegetables for children ages 3-7. This study has developed a food product containing vegetables that was accepted by children in this age range. A beginning step to better nutrition is getting the children to consume the vitamins and minerals found in the vegetables. From there, exposing them to the ingredients of the popsicles, the vegetables, may help them to realize that eating vegetables can be fun. After this, they may then be asked to try the vegetables in their natural form. The importance of this study was to first get the children to consume the vitamins and minerals found in the vegetables.

References

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Appendix

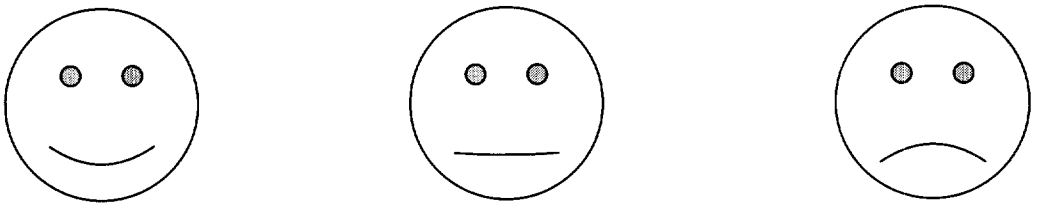
Child #_____

Evaluation of Popsicle Week #_____

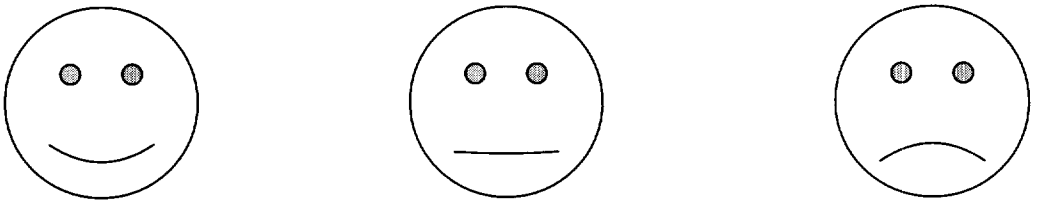
To be read before giving popicle to the child:

You are going to be trying a new popsicle today for snack. It is important that you try the popsicle because one of your teachers or I will be asking you questions about how you liked it when you are finished. If you really do not like the popsicle, you do not have to finish it, but we do ask that you at least try it.

1) Which face would you use to describe the taste/flavor?

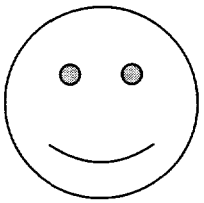
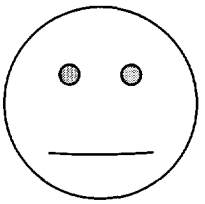
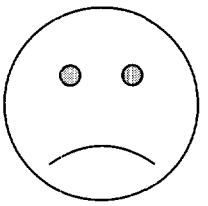


2) Which face would you use to describe the color?



Child #_____

3) Would you eat this again if you could?

4) What did you like about the popsicle? _____

_____

_____

5) What did you not like about the popsicle? _____

_____

_____

6) Additional Comments_____

_____

_____

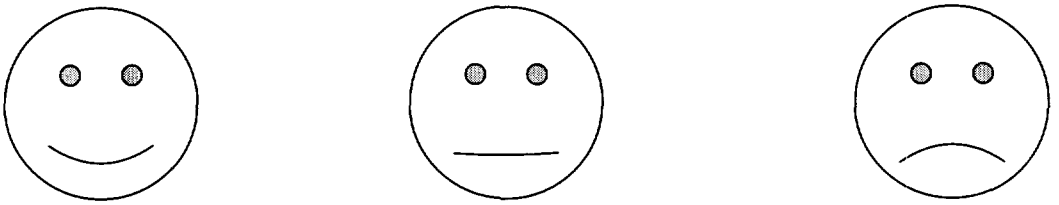
_____

_____

Child #_____

Exit Survey Regarding Attitudes Toward Vegetables

1) Which face best fits how you feel about vegetables?



2) Can you name some vegetables? _____

_____

_____

_____

3) Did you eat any of these vegetables yesterday? Yes No _____

4) Tell me what a carrot looks like_____

_____

Would you eat it? _____

5) Tell me what broccoli looks like_____

_____

Would you eat it?_____

6) What does celery look like?_____

_____

Child #_____

Would you eat it?_____

7) Tell me what a beet looks like_____

_____

Would you eat it?_____

8) Additional comments_____

_____

_____

_____

_____

_____

_____